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ABSTRACT

In 19th century America the textbook for reading, or "reader," was predominant as the learning tool for young children. Science selections in these readers introduced students to their first formal science instruction. This paper presents an analysis of the science used in 19th century popular readers. Through a synthesis of expert opinion, the most popular readers (n=46) occurring in 20 year intervals were selected, and then analyzed for quantity of science (by page and by article), content of science (biology, earth science, and physical science), and for how science was used. Results indicate that the average percentage of pages devoted to science in the readers during the 19th century was 17.8. The amount of science peaked in the middle of the century. It is suggested that the inclusion of more science in the readers reflected the growing popularity of science in society; however, a push to make reading more literary was in part responsible for the decrease in science observed in readers at the end of that century. The percentage of science selections that were biological in nature steadily increased and the percentage of earth science topics steadily decreased. Science selections in the readers were presented in a variety of formats, including: didactic explanations, dialogues, stories, poetry, and questions with answers. (Contains 26 references.) (PR)

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Science in American School Readers
of the Nineteenth Century

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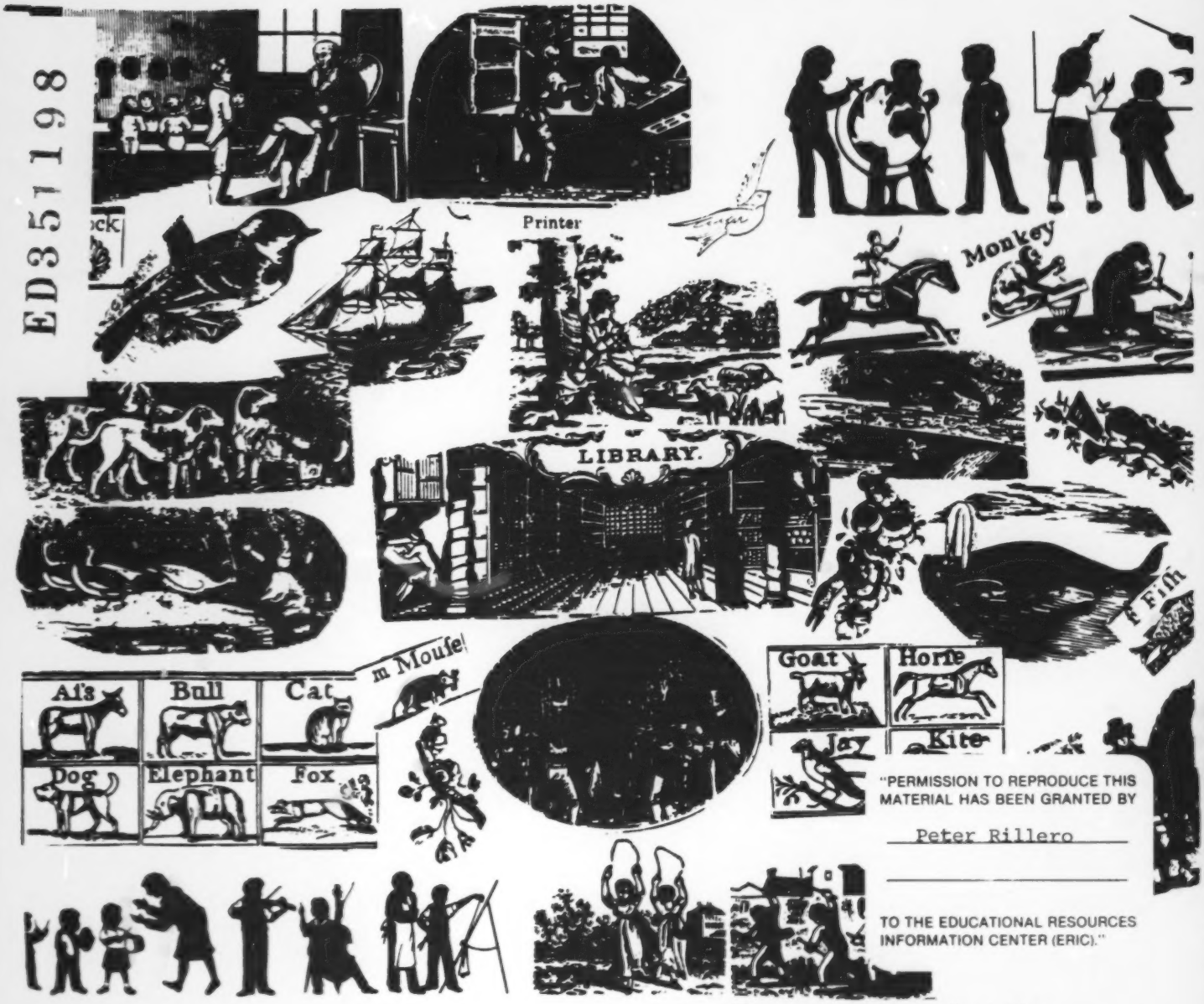

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Introduction:

In nineteenth century America the textbook for reading, the reader, was predominant as the learning tool for young children. Readers were not only designed to teach children to read, they were designed to give a broad education. Did the most widely used readers of the nineteenth century provide American children with significant amounts of scientific information, along with their predominant literary exposure? If so, what types of science were presented in the readers? Are there links from the science in the nineteenth century readers to that extended into twentieth century programs? These are the questions we will try to answer as we examine the science in readers.

Science education in America has historically and contemporarily been dependent upon textbooks. William T. Harris (1880) concluded an article with "'Text-book instruction' is the form of school instruction adopted by the deep instinct of modern society, as the most direct and effective method of initiating the individual man into spiritual participation in the activity of his race. By it our system of instruction is best enabled to secure what is substantial without sacrificing the formal" (p. 9). Today, the textbook still holds a dominant position in American education. Historically, American children first learned about science in schools through textbooks; the first of these to contain science were the introductory reading textbooks .

Textbooks were extremely important in nineteenth century education systems. In part this was due to the large number of untrained teachers who were in the classrooms. "Few teachers outside of the large cities had much education beyond that of the schools in which they taught" (Elson, 1964, p.8). From the start these teachers relied heavily on the familiar textbook. "A nineteenth-century work on the theory and

practice of teaching suggests that teachers be better prepared; the author believed that this could be accomplished if the teacher would read over the textbook before class. Apparently, this would have constituted a reform" (Elson, 1964, p.8). "The teachers in the early days of our country were so meagerly trained and educated that they depended strongly on the textbooks for what to teach and how to teach. Most authorities agree that in the United States the old textbooks in use in any particular school largely constituted the school's course of study. And so an analysis of old American school textbooks reflects the evolution of the American school curriculum and the teaching and learning methods" (Nietz, 1961, p.1).

Common schools evolved into today's elementary schools (Nietz, 1961) and readers were their most important textbook. Almost the entire instruction in primary schools was centered around spelling, reading, and writing and by the age of six, most of the instruction in these three areas was in reading (Soltow & Stevens, 1981). In fact, the early Puritan schools in America had the primary purpose of teaching reading so their students could read the Bible. The importance of the introductory reading textbook is apparent in an 1828 report on the common schools in Connecticut, where it is reported that twenty-nine different kinds of reading books, eight spelling-books, eight arithmetics, six grammars, ten geographies, and five histories were used (Belok, 1973). The larger variety of readers published as compared to other textbooks indicates the importance of readers in common school education.

Readers consisted of articles or lessons usually written by different authors which were selected by the compiler. Different compilers of readers often used the same selections. Popular readers were often copied by other compilers.

Usually, school books were owned by the individuals rather than by the school. Frequently the same book was used by many family and community members. "Sometimes as many as a dozen readers would inscribe a book over the course of a

few generations, again suggesting that a book was not just a commodity but a special possession, an inheritance or a gift" (Davidson, 1986, p.70).

The science selections in the readers were the nineteenth century student's first formal introduction to science. These lessons constituted the beginning of science education in America for students in the lower grade levels.

Methods and Rationale

Nineteenth century readers are analyzed to determine which lessons were scientific in nature. The science lessons are further classified into three branches of science: biological sciences, earth sciences, and physical sciences. Representative nineteenth century readers are analyzed for twenty year intervals.

In the case of readers that came in a graded series, only the first three books are analyzed. These readers provided the first exposure of the child to the world of science, and a child who completed the first three books was often considered well educated. One author writes that in the middle part of the nineteenth century, "children who attended school regularly in the primary grades achieved a level of reading of approximately that found in *McGuffey's Third Reader* " (Soltow & Stevens, 1981, p.102). This was a significant achievement. As Nietz, reports in 1961, "The application of the Yoakam Readability Formula to an early edition of the [McGuffey] *Second Reader* revealed that its vocabulary was at the eighth grade level" (p.77). "Most nineteenth century students completed the second reader before leaving school, but many left before completing the third. Anyone who completed mastery of the fourth reader was considered well educated" (Lindberg, 1976, p. xv).

The number of students who continued beyond primary school was small. Prior to 1890, only 3.8 percent of the population between 14 and 17 years of age enrolled in school (Hurd, 1961). Many nineteenth century primary schools did not teach science as a separate subject (Underhill, 1941). Thus, for many nineteenth century American

school children, the science in the early primary readers may have not only have been the first science they encountered, it may also have been the only formal science they ever encountered.

If the main point of the article or lesson presents scientific information, for example about an organism or a structure of the earth, the article is classified as scientific in nature. The science content is further classified into the type of science: biological, earth, or physical science. Biology consists of zoology, botany, and physiology. Earth science consists of physical geography, geology, meteorology, and astronomy. Physics and chemistry are the subjects of physical science. These subject groupings are almost identical to the groupings made for science conferences in 1892 for the Committee of Ten (National Education Association, 1893). The only difference is that astronomy was placed with physics and chemistry during these conferences.

The science content in this analysis is quantified as to both number of lessons and number of pages. The length of the lesson is recorded to the nearest quarter of a page. The data are also reported as a percentage of total pages and as a percentage of total lessons.

It is important that we analyze readers which are most representative of their day. The most popular readers are selected because they were the most commonly used and most often imitated. Methods by other researchers to assess popularity of the readers include ascertaining the number of copies sold, the number of editions published, and recommendations of school boards (Smith,1967).

Smith (1967), Nietz (1961), Carpenter (1967), and Reeder (1900) each wrote important books treating American readers. Each author indicated which readers he or she considered most popular in the nineteenth century. For this study, the works of these four authors are interpreted in order to arrive at a list of the most popular nineteenth century readers for twenty year intervals (appendix 1).

In the period from 1800 to 1819, there is unanimity among these authors about the popular readers. The readers of Noah Webster (1754-1843), Caleb Bingham (1757-1819), and Lindley Murray (1745-1826) were the most popular. The first truly American reader was Webster's *Grammatical Institute of the English Language, Part 3;* it was issued in 1785 (Carpenter, 1967; Nietz, 1961; Reeder, 1900). The title for subsequent editions was changed to *An American Selection of Lessons in Reading and Speaking, calculated to improve the mind and refine the taste of youth, and also to instruct them in Geography, History, and Politics of the United States.* The *American Selections* had competition from Caleb Bingham's most popular readers, *The American Preceptor* and *The Columbian Orator*, as well as from Lindley Murray's *English Reader, A Sequel to the English Reader*, and the *Introduction to the English Reader* (Carpenter, 1967; Nietz, 1961; Reeder, 1900; Smith, 1967). Murray's readers overtook both Webster's and Bingham's in popularity (Nietz, 1961; Carpenter, 1967). Of these, the *English Reader* was the most popular and it continued to be used throughout the first half of the nineteenth century (Carpenter, 1967; Nietz, 1961; Reeder, 1900).

In the period of 1820 to 1839 several new popular readers appeared. John Pierpont (1785-1866) produced a very popular series (Smith, 1967; Nietz, 1961; Reeder, 1900) of which the first three were the *Young Reader*, the *Introduction to the Reader*, and the *National Reader*. Lyman Cobb (1800-1864) introduced a widely used reading series known as the *Juvenile Readers* (Carpenter, 1967; Nietz, 1961; Reeder, 1900; Smith, 1967). The works of Murray continued to be reprinted in this period and are included in the analysis because they continued to be widely used.

The period of 1840 to 1859 saw the readers of William McGuffey (1800-1873) soar in popularity (Carpenter, 1967; Nietz, 1961; Reeder, 1900; Smith, 1967). McGuffey's first editions were actually published in 1836 and 1837, however they only

became widespread and popular after 1840 (Nietz, 1961). For this reason, they are first listed in this twenty year period. *McGuffey's Eclectic Readers* are the most famous and influential textbooks in American education history (Westerhoff, 1978). The sales of these readers were astounding. "Mr. Louis Dillman, president of the American Book Company in 1920 estimated that seven million copies were sold during 1836-1850, forty million during 1850-1870, sixty million during 1870-1890, and fifteen million during the 1890-1920 period" (Nietz, 1961, p.73). "To arrive at the number of pupils who used these readers one would have to multiply this figure by perhaps four or five, as they were treasured and passed on from older to younger members of families as they were needed" (Mathews, 1966, p.102). The readers of Charles W. Sanders (1805-1889) were also popular during the 1840-1859 period (Carpenter, 1967; Nietz, 1961; Reeder, 1900). In fact, for the first few years Sander's readers had greater use than McGuffey's (Carpenter, 1967). Included in this period are Cobb's revised readers, the *New Juvenile Readers*, which were first issued in 1842 (Nietz, 1961). The only Murray work to be retained in this period is the *English Reader*.

In the twenty year period of 1860 to 1879 the new editions of McGuffey and Sanders are used in this content analysis. Also, the readers of G.S. Hillard (1808-1879) and the National Series by Parker and Watson became widely used (Carpenter, 1967; Nietz, 1961; Reeder, 1900; Smith, 1967).

For the period of 1880 to 1899, Reeder (1900) and Smith (1965) did not cite any readers based on their popularity and thus, they cannot be used to determine this period's popular readers. Lamport (1937) is substituted for Reeder and Smith as a source of information about popularity for this period. William T. Harris (1835-1908) produced the popular Appleton Readers (Carpenter, 1967; Nietz, 1961; Lamport, 1937). Also, the Baldwin Readers were popular at the turn of the century (Carpenter,

1967; Nietz, 1961). As previously mentioned, the McGuffey readers still were widely used and are included in this period's content analysis.

Results

Science content is significant in the readers of all the periods (table 1, appendix 2). The mean amount of science in readers during the nineteenth century was 12.8 percent of the total page contents. The mean percentage of the lessons devoted to science was 14.3 percent.

(INSERT TABLE 1 APPROXIMATELY HERE)

Science content in the readers increased in amount from the beginning of the century, peaking in the middle of the century (figure 1). At the beginning of the century the mean science content of the book was only 3.9 percent of the pages. This amount reached a peak of 19.6 percent in the 1840 to 1859 period. The percentage of science lessons in the readers started at 5.3 percent and peaked in the 1820 to 1839 period at 20.5 percent.

(INSERT FIGURE 1 APPROXIMATELY HERE)

Of the 552 science lessons examined, the percentage which focused on biology rose constantly during the century. At the beginning of the century, biology represented 53.3 percent of all of the science lessons and at the end of the century it grew to 90.5 percent (table 2). The increase in biology content roughly follows the decrease in earth science content (figure 2). Earth science decreased during the 100 years from 43.3 percent to 6.7 percent. Physical science started the century at 3.3 percent increased to 9.3 percent during the middle of the century and closed the century at 2.8 percent.

(INSERT TABLE 2 and FIGURE 2 APPROXIMATELY HERE)

How Science was Used.

Science was presented in readers in a variety of forms. Sometimes the

Table 1.
Data Showing Number and Percentage of Science Pages and Lessons in Readers for Twenty Year Periods.

				Science		Percent Science	
Period	readers	pages	lessons	Lessons	pages	by lesson	by page
1800-1819	6	1645	568	30	63.5	5.28%	3.86%
1820-1839	9	1666	889	182	238.25	20.47%	14.30%
1840-1859	10	1770	699	124	347.25	17.74%	19.62%
1860-1879	12	1950	1101	127	239.25	11.53%	12.27%
1880-1899	9	1428	618	89	191.25	14.40%	13.39%
Totals	**46**	**8459**	**3875**	**552**	**1079.5**	**14.25%**	**12.76%**

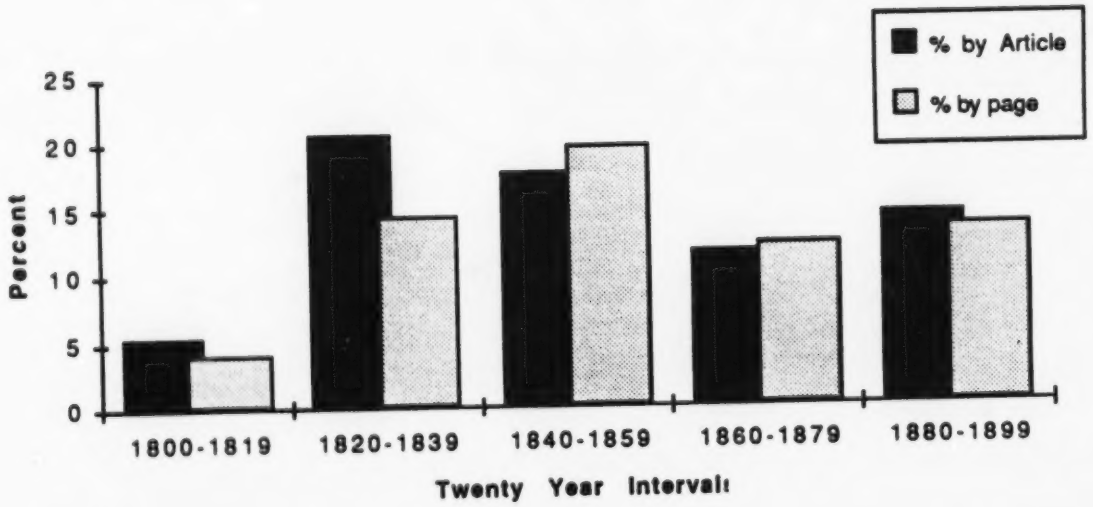

Figure 1. Percentage of science in nineteenth century readers.

Table 2.
Amount of biological, earth, and physical science lessons in nineteenth century readers.

Period	Sci Les.	B.S.	E.S.	P.S.	BS/sci	ES/sci	PS/sci
1800-1819	30	16	13	1	53.33%	43.33%	3.33%
1820-1839	182	140	28	14	76.92%	15.38%	7.69%
1840-1859	124	95	17.5	11.5	76.61%	14.11%	9.27%
1860-1879	127	113.83	7.33	5.83	89.63%	5.77%	4.59%
1880-1899	89	80.5	6	2.5	90.45%	6.74%	2.81%
Totals	**552**	**445.33**	**71.83**	**34.83**	**80.68%**	**13.01%**	**6.31%**

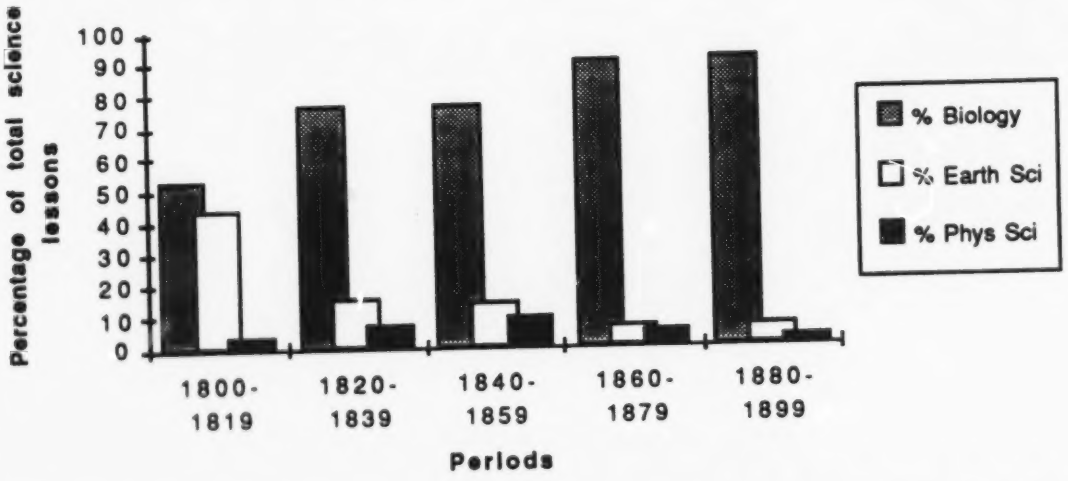

Figure 2. Variation in type of science used in nineteenth century readers.

presentation was a straightforward explanation of facts; as is common to science textbooks of today. For example the entire lesson "The Chameleon" from Cobb's *Juvenile Reader Number 3* (1831) is:

> "1. The chameleon is an animal,with a naked body, a tail, and four feet.
> 2. The body is six or seven inches long, and the tail is five inches ; with this it clings to the branches of trees.
> 3. The skin is cold to the feel, and contains small grains or eminences, of a bluish gray colour, in the shade, but in the light of the sun, all parts of the body become of a grayish brown, or tawny colour.
> 4. The chameleon is a native of Africa and Asia" (p. 45).

Other formats, such as dialogues between an adult and a child or children, stories, poetry, and written questions and answers, were also used to present science.

While frequently the science lessons stood alone, effort was sometimes made to unite them with other types of lessons. For example, a scientific description would sometimes precede a story about an organism or natural event. In Baldwin's second year reader (1897), there is a biology lesson describing rabbits and turtles with the subsequent lesson being the classic fable about the tortoise and the hare. McGuffey's third reader (1853) contains a scientific selection on thunderstorms directly before a poem describing the stillness before a storm and then the fierceness of the storm. Many of the science lessons end with some fascinating anecdotes about human encounters with the organism being discussed. This is so for "The Fox" in McGuffey's second reader (1853). After a accurate description of the characteristics of foxes, there is a short passage about a fox that was trained to turn a spit for a kitchen fire.

Morality lessons were very much a part of the readers of the nineteenth century. Stories were used to promote honesty, hard work, patriotism, humility, and goodness. McGuffey's second reader (1853) contained a lesson on the partridge which contained seven paragraphs describing the biology of this unique organism. The final paragraph ended with "Little boys and girls, be not like the peacock, proud and vain, on account of your beauty and your fine clothes; for humility and goodness are always

to be preferred to beauty" (p. 55).

Most of the readers contained lessons designed to prevent cruelty to animals. We judge many of these not to be biology lessons, but to be morality lessons. However, some selections combined biology with morality. For example, in Hillard's third reader (1864) is a lesson "Thoughtless Cruelty" in which an uncle expresses his displeasure with his nephew for throwing stones at birds. The uncle then proceeds to describe unique biological aspects of birds. The lesson ends with, "Remember, therefore, that God has made the birds as well as you, and that He cares for them as well as for you" (Hillard, 1864, p.93).

As the previous example shows some reader selections emphasized religious interpretations. God was frequently mentioned and praised in the science lessons. In a lesson entitled "The Nettle" which appeared in McGuffey's third reader (1848), a father tells his daughter about botany and nettles and their uses after she was stung by one. He ends by saying, "Thus, you see, that even the despised nettle is not made in vain; and this may teach you, that we only need to understand the works of God, to see that, 'in goodness and wisdom he has made them all'" (McGuffey, 1848, p.46). In Sander's first reader (1871), a selection depicts children's fascination with fire-flies. The mother tells them at the end, "the earth is full of the works of the Lord, and no life is long enough to learn them all" (p.82).

Discussion

Throughout the nineteenth century there was a significant amount of science in the readers. The rise in science content from the beginning to the middle of the nineteenth century probably reflects the increasing popularity of American science. During the nineteenth century *The Scientific American* (1845) and *Popular Science* (1872) magazines were established. Works of major scientists such as those of Joule, Kelvin, Galvani, Volta, Ampere, Dalton, Faraday, Darwin, Pasteur, Lister, Maxwell,

Oersted, and Hertz were widely disseminated. Technological developments were being made at a rapid pace. For example, before 1840 only a few hundred patents were issued per year, while in 1860, 5,000 patents were issued (Underhill,1941). This period was one of great scientific accomplishments, professionalization of scientists, and popularization of science.

The question that must be asked is why did the relative amount of science in readers decrease in the last part of the century? One reason seems to be that independent elementary school science started to gain acceptance. For all of the talk and excitement about science, relatively little of it was actually taught as a special subject in nineteenth century common schools. However, near the end of the century science as a separate elementary school subject gained a wider acceptance. According to the U.S. Commissioner's Report for 1880-1889, the average time teaching science ranged from 0.7 percent (Detroit) to 9.7 percent (Washington, D.C.) with the average time officially reported for all cites being 4.6 percent. Cities such as Kansas City, Chicago, Cincinnati, and Milwaukee had no science courses below sixth grade (Underhill, 1941). However, elementary science started to become a subject in its own right and compilers may have felt a reduced need to include much science selections in readers.

The decrease in the percentage of science content may be due to a desire of some educators to use literary, rather than factual, readings as a way of teaching reading. Leading the campaign was Charles Eliot who wrote in 1891 that he objected to readers because they are not real literature (Smith, 1967). The Conference on the Study of English of the Committee of Ten recommended that "Reading-books should be of a literary character and should not attempt to teach physical science or natural history" (National Education Association, 1893, p. 89).

The reduction of science in readers during the last part of the nineteenth

century may have been a backlash against the large amount of science being used in some readers. Reeder (1900) discusses the readers of Marcius Wilson which were heavily laden with science. For example in Wilson's third reader there are only four subject headings: Stories From the Bible; Moral Lessons; Zoology and Miscellaneous. The section on zoology accounted for 60 percent of the pages. Reeder states that Wilson's books created debate as to what should be the central core of a reading series. "The Wilson series showed the absurd limit to which the utilitarian principle might lead, and the necessity for finding the true center for this branch of curriculum. In the struggle for the central position, literature gradually emerged from the conflict triumphant over those subjects which are confined within the limits of time and space, and in the new series and supplementary readers which began to appear about 1880, literature took the field, and since then has held it against all comers" (Reeder, 1900, p.160).

The decline in the percentage of pages devoted to science content first starts in the period 1860-1880. This period was also the period when the object teaching movement was strongest (Underhill, 1941). The philosophy of object teaching was to get students to learn about the world through interactions with real objects and not through the use of books. Studying objects, such as living things and rocks, exposed students to science. In fact, object teaching is generally recognized as an early form of elementary science (DeBoer, 1991). Do to the impact of object teaching, compilers may have reduced the amount of science in their readers.

A strict interpretation of the object teaching philosophy would lead to the conclusion that students should learn from things and not books. However, lessons often tended to stress verbalism and the use of a textbook contrary to the intent of the theorists (Reisner, 1930). This encouraged some writers and compilers to present object lessons through books. A report by the National Teachers' Association in 1865

indicates that the Pestalozzian method of object teaching had influenced reading (Robinson, 1930). Hollis, in 1898, uses his observation of the change in textbooks in the thirty previous years, as an example of the great popularity of the Oswego based object teaching reforms. In our examined readers some lessons used the question and answer form promoted by object teaching. For example, in Baldwin's first reader (1897) are a series of questions and some answers on ants. Some questions, such as "How many legs has he?", rely on the illustrations for the student to determine an answer. "Lessons on Objects" in Hillard's third reader also shows the impact of object teaching. This lesson consists of a list of 26 questions with no answers provided. Thus, there is evidence that object teaching impacted readers.

Object lessons frequently used biological themes, which may have influenced the increase in percentage of science which focused on biological content in these nineteenth century readers. Living organisms and the human body were interesting to children and very accessible. Calkins (1882) in *Manual of Object-Teaching* describes the importance of living organisms in object teaching. "Living, moving forms possess the greatest attractions for children. The life and motions exhibited in the animal world corresponding to the activity of childhood, place animals among the earliest and most interesting objects that awaken the curiosity of the young" (p. 171). Plants were also frequently used in object lessons.

Rousseau and other romantic writers after him were influential in creating a feeling of wonder for nature (McCulloch, 1979). Impetus for the idea of nature study came in the writings of such people as Emerson, Thoreau, Whittier, Longfellow, and Lowell between 1830 and 1860 (Underhill, 1941). Their writings reflected a theme of love of nature and the out-of-doors. The nature study movement reached its peak in the years 1890-1920 (Underhill, 1941). The interest in nature as a result of these writers and the nature study movement may have induced compilers of readers to

increase the amount of biology in their books.

Nature study as an educational program officially began at Cornell University during the depression of 1891-1893 as a way to prevent young people from migrating from the farms to New York City (Underhill, 1941). As society increasingly became more urban, educators may have felt more of a need to describe nature to city children, and thus increased the biological content of readers. After the Civil War, physiology as a separate subject became popular and elementary books with emphasis on the evils of alcohol and narcotics appeared. The increases in popularity of these biological topics may have further influenced nineteenth century compilers to have more biological content in their readers.

During the latter part of the eighteenth century there was a feminization of the teaching force. Botany was thought of as a suitable study for young women in the nineteenth century (Rudolph, 1982). The large number of female teachers and the strong botanical background of many women, may have led compilers to stress this subject.

While biology increased, the earth science in readers decreased. This may have been because biology became a more popular subject. However, earth sciences may have decreased in readers because geography textbooks became readily available as geography appeared as an independent subject. Finney (1921) points out that geography had little place in the common schools in the 1820s. However, it gained steadily throughout the century and secured a recognizable place in the elementary school after the Civil War (Finney, 1921). In 1893, the Committee of Ten stated "geography has been a subject of recognized value in the elementary schools for many generations" (National Education Association, 1893, p.31). Special geography textbooks or geography readers were used in teaching this subject. These books contained earth science topics such as astronomy, winds, tides, and soils. By

1850, these physical geography topics were strongly emphasized in geography textbooks (Underhill, 1941). As this subject secured a place in the elementary curriculum, compilers of readers may have decided to decrease the amount of earth science material.

Considering the success of the industrial revolution it is surprising that more physical science was not present in the readers. However, as Soltow and Stevens (1981) state, "in the early nineteenth century there is no doubt that tradition weighed more heavily than change" (p. 96). Compilers of readers may have neglected the physical sciences because they require greater mathematical background than young students may have had. Also, they can be less visual than either the biological or earth sciences.

Current Trends

Some of the trends identified in nineteenth century readers appear in contemporary science education. Today, many elementary educators are seeking greater integration of science with other subjects. There are many examples in nineteenth century readers which show educators were trying to integrate literature and poetry with science.

Flood and Lapp (1987) reported the amount and kind of science in contemporary readers. Of the readers they examined, 17.5 percent contained expository writing, of which 33 percent was scientific. A content analysis was only done on the expository selections, however, it is likely that the other types of writing (narrative, poetry, plays, biography, hybrid) contained minimal science. Thus, 5.8 percent of the selections dealt with science. Based on this study, the amount of science in readers has decreased from 14.4 percent at the end of the nineteenth century to the recent content of 5.8 percent. In Flood and Lapp's analysis of the type of science in the expository selections 58.9 percent of the science selections were life

science, 21.8 percent earth science, and 19.3 percent physical science. This is similar to our analysis of readers in the nineteenth century in that biology is the most prevalent science subject followed by earth science and then physical science. However, in the twentieth century, the amount of biological science has decreased as earth science and physical science selections have increased.

The percentage of science content in the nineteenth century readers appears to be roughly equivalent to the percentage of science taught in the elementary schools today. Towsley and Voss (1988), in a synthesis of research, report that state and school districts' average recommendation is for elementary science to be taught for thirty to forty minutes per day. However, in reality teachers report only teaching twenty or thirty minutes of science per day. Using the figure of thirty minutes per day, and assuming students receive five hours of instruction per day, this would mean that ten percent of an average day is spent on science. This is similar to the average percentage of space (12.8) devoted to science in nineteenth century readers.

Naturalist writers and the nature study movement caused an increase in the biological content of readers. These same forces also influenced the biological focus of elementary science education which evolved from nature study. The principles of nature study may have influenced high school science as well (Underhill, 1941), which may help to explain the popularity of biology as a high school subject.

Conclusions

An analysis of content in American nineteenth century readers shows not simply what educational leaders thought should be taught, but what was actually taught. An average of 12.8 percent of the nineteenth century reader pages were devoted to science. The amount of science peaked in the middle of the century. The greater emphasis on literature partially pushed science out of the readers. At the same time science in elementary schools was becoming an independent curriculum

area.

The type of science in the readers changed during the century. The percentage of science content that was biological in nature steadily increased, while the percentage of earth science lessons steadily decreased. Physical science in the nineteenth century readers showed no steady increase or decrease.

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IN MEMORIAM

EMANUEL D. RUDOLPH
(1927 – 1992)

The Board of Trustees of The Ohio State University expresses its sorrow upon the death June 22, 1992, of Emanuel D. Rudolph, Professor Emeritus of the Department of Plant Biology.

Professor Rudolph was born September 9, 1927, New York, New York. He received his B.A. from New York University in 1950 and his Ph.D. from Washington University (St. Louis) in 1955.

Dr. Rudolph taught in the Department of Botany (now Plant Biology) from 1961 – 89; was chairperson of that department from 1978 – 87; he took early retirement in 1989 and continued to teach one course a year. He served as Director of the Institute of Polar Studies (now Byrd Polar Research Center) from 1969 – 73, and Director of the Environmental Biology Graduate Program, 1972 – 78. And he was curator in the Ohio State University Herbarium.

Dr. Rudolph did research on lichens and the history of botany, authored numerous scientific papers on those topics, edited a book on symbiosis and parasitism, wrote more than 150 book reviews in major journals, and presented more than 100 papers at scientific meetings. He was active in professional societies and other organizations; he was a Fellow of the American Association for the Advancement of Science, a Fellow of the Ohio Academy of Science, a Fellow of the Arctic Institute of North America and a Fellow of the Linnean Society of London. Dr. Rudolph was the recipient of several awards and honors, among them; the Antarctic Medal of the United States, in 1979. "Rudolph Glacier" in Victoria Land, Antarctica was named after him by the U.S. Board of Geographical Names, and *Edrudia*, a genus of lichens, was named after him in 1980.

Dr. Rudolph was President-Elect of the Ohio Academy of Science; President-Elect of the Friends of the Library (Ohio State University), a group of which he was a founding member and ardent supporter; and Past President of the Friends of the Byrd Polar Research Center.

Dr. Rudolph was a respected researcher, valued teacher and mentor, and generous friend to people in many areas, at Ohio State and around the country. His enthusiasm for learning and scholarship, his gentle good humor and cooperative spirit, were a positive example to all who knew him.—*Ronald L. Stuckey and Barney L. Lipscomb.*

SIDA 15(1): 165. 1992

Appendix 1. Bibliography for Readers used in Science Content Analysis Organized by Year of Publication

1800-1819

Webster, Noah. (1803). An American Selection of Lessons in Reading and Speaking. Baltimore: Thomas Andrews.

Bingham, Caleb. (1805). The American Preceptor: Being a New Selection of Lessons for Reading and Speaking. 23rd edition. Boston: Manning and Loring.

Murray, Lindley. (1808). Sequel to the English Reader: or, Elegant Selections in Prose and Poetry. New York: Collins and Perkins.

Murray, Lindley. (1812). Introduction to the English Reader. Philadelphia: Bennett and Walton.

Bingham, Caleb. (1815). The Columbian Orator. Sixth Troy Edition. Troy: Parker and Bliss.

Murray, Lindley. (1818). The English Reader: or, Pieces in Prose and Poetry, Selected from the Best Writers. Pittsburgh: Patterson and Lambdin.

1820-1939

Murray, Lindley. (1826). The English Reader: or, Pieces in Prose and Poetry, Selected from the Best Writers. Philadelphia: Edwin T. Scott.

Murray, Lindley. (1827). Sequel to the English Reader: or, Elegant Selections in Prose and Poetry. Philadelphia: S. Probasco.

Pierpont, John. (1828). Introduction to the National Reader. Boston: Richardson and Lord.

Murray, Lindley. (1829). Introduction to the English Reader. Pittsburgh: Bennett and H. Holdship and Son.

Pierpont, John. (1829). The National Reader. Boston: Richardson, Lord, and Holbrook.

Cobb, Lyman. (1830). Cobb's Juvenile Reader Number 1. Ithaca: Andrus, Woodruff, and Gauntlett.

Cobb, Lyman. (1831). Cobb's Juvenile Reader Number 2. Chambersburgh, Pa.: Hickok and Blood.

Cobb, Lyman. (1835). Cobb's Juvenile Reader Number 3. Bennington, Vt.: John C. Haswell.

Pierpont, John. (1835). The Young Reader: to go with the Spelling Book. New York: George F. Cooledge.

1840-1859

Sanders, Charles W. (1840). The School Reader. Second Book. Cincinnati: William H. Moore and Company.

Cobb, Lyman. (1842). Cobb's New Juvenile Reader. Number I. Ithaca: Mack, Andrus and Co.

Cobb, Lyman. (1845). Cobb's New Juvenile Reader. Number II. Oxford, N.Y.: W. E. Chapman.

Sanders, Charles W. (1843). The School Reader. First Book. New York: Mark H. Newman.

McGuffey, Wm H. (1844). McGuffey's Newly Revised First Reader: The Eclectic First Reader for Young Children. Cincinnati: Winthrop B. Smith.

Cobb, Lyman. (1845). Cobb's New Juvenile Reader. Number III. Cincinnati, B. Davenport.

Murray, Lindley. (1846). The English Reader: or, Pieces in Prose and Poetry, Selected from the Best Writers. Philadelphia: W.A. Leary.

McGuffey, Wm H. (1848). McGuffey's Newly Revised Eclectic Third Reader. Cincinnati: Winthrop B. Smith.

Sanders, Charles W. (1848). The School Reader. Third Book. New York: Ivison and Phinney.

McGuffey, Wm H. (1853). McGuffey's Newly Revised Eclectic Second Reader. Cincinnati: Sargent, Wilson, and Hinkle.

1860-1879

Sanders, Charles W. (1861). The School Reader. Third Book. New York: Ivison and Phinney.

McGuffey, Wm H. (1863). McGuffey's New First Eclectic Reader. Cincinnati: Van Antwerp, Bragg and Co.

Hillard, G.S. and L.J. Campbell. (1864). The New Series. The Primer of First Reader. Philadelphia: Eldridge and Brother.

McGuffey, Wm H. (1863). McGuffey's New Second Eclectic Reader: for Young Learners. Cincinnati: Wilson, Hinkle and Co.

McGuffey, Wm H. (1865). McGuffey's New Third Eclectic Reader: for Young Learners. Cincinnati: Wilson, Hinkle and Co.

Sanders, Charles W. (1869). Sander's New Series. The School Reader. Second Book. New York: Ivison, Phinney, Blakeman and Co.

Parker, Richard Green and Watson, J. Madison. (1860). National First Reader or Word-Builder. New York: A.S. Barnes and Co.

Parker, Richard Green and Watson, J. Madison. (1869). National Third Reader or Word-Builder. New York: A.S. Barnes and Co.

Sanders, Charles W. (1871). Sander's New Series. The School Reader. First Book. New York: Ivison, Blakeman, and Taylor and Co.

Parker, Richard Green and J. Madison Watson. (1857 and 1885). National Second Reader or Word-Builder. New York: A.S. Barnes and Co.

Hillard, G.S. and L.J. Campbell. (1873). The New Series. The Third Reader. for Primary Schools. Boston: Brewer and Tileson.

Hillard, G.S. and L.J. Campbell. (1873). The Franklin Second Reader. New York: Taintor Brothers, Merril and Co.

1880-1899

Harris, William T. and Rickoff, Andrew J. (1884). Appleton's School Readers. The First Reader. New York: D. Appleton and Co.

McGuffey, Wm H. (1885). McGuffey's New First Eclectic Reader: for Young Learners. New York: American Book Company.

McGuffey, Wm H. (1885). McGuffey's New Third Eclectic Reader: for Young Learners. New York: American Book Company.

Harris, William T. and Rickoff, Andrew J. (1886). Appelton's School Readers. Second Reader. New York: D. Appleton and Co.

Harris, William T. and Rickoff, Andrew J. (1887). Appelton's School Readers. The Third Reader. New York: D. Appleton and Co.

McGuffey, Wm H. (1896). McGuffey's Second Eclectic Reader, Revised Edition. New York: American Book Company.

Baldwin, James. (1897). Baldwin's Readers First Year. New York: American Book Company.

Baldwin, James. (1897). Baldwin's Readers Second Year. New York: American Book Company.

Baldwin, James. (1897). Baldwin's Readers Third Year. New York: American Book Company.

Appendix 2. Science content of nineteenth century readers by lesson and page.

					Science				Type of Sci Les					
1800-1819	**Author**	**Year**	**pp.**	**Les**	**Les**	**pp.**	**% Sci les**	**% Sci pp**	**BS**	**ES**	**PS**	**BS/sci**	**ES/sci**	**PS/sci**
American Selection	Webster	1803	239	55	1	9	1.82%	3.77%	0	1	0	0.00%	100.00%	0.00%
American Preceptor	Bingham	1805	228	101	8	13.25	7.92%	5.81%	5	3	0	62.50%	37.50%	0.00%
Sequel to the Eng Rr	Murray	1808	360	75	4	11.75	5.33%	3.26%	2	2	0	50.00%	50.00%	0.00%
Intro to the Eng Rr	Murray	1812	255	115	4	9.75	3.48%	3.82%	4	0	0	100.00%	0.00%	0.00%
Columbian Orator	Bingham	1815	300	83	3	5.25	3.61%	1.75%	1	1	1	33.33%	33.33%	33.33%
The English Rr	Murray	1818	263	139	10	14.5	7.19%	5.51%	4	6	0	40.00%	60.00%	0.00%
Totals	6 Readers		**1645**	**568**	**30**	**63.5**	**5.28%**	**3.86%**	**16**	**13**	**1**	**53.33%**	**43.33%**	**3.33%**
1820-1839														
The English Reader	Murray	1826	252	139	10	14.75	7.19%	5.85%	4	6	0	40.00%	60.00%	0.00%
Seq to the Eng Rr	Murray	1827	244	75	4	7.5	5.33%	3.07%	2	2	0	50.00%	50.00%	0.00%
Intro to the Nat'l Rr	Pierpont	1828	168	94	19	40.75	20.21%	24.26%	17	2	0	89.47%	10.53%	0.00%
Intro to the Eng Rr	Murray	1829	132	86	7	17.25	8.14%	13.07%	7	0	0	100.00%	0.00%	0.00%
The National Rr	Pierpont	1829	276	143	7	14.25	4.90%	5.16%	1	5	1	14.29%	71.43%	14.29%
Juvenile Rr No. 1	Cobb	1830	72	58	21	22	36.21%	30.56%	16	5	0	76.19%	23.81%	0.00%
Juvenile Rr No. 2	Cobb	1831	144	43	10	17.75	23.26%	12.33%	8	2	0	80.00%	20.00%	0.00%
Juvenile Rr No. 3	Cobb	1835	216	166	92	77	55.42%	35.65%	76	3	13	82.61%	3.26%	14.13%
The Young Reader	Pierpont	1835	162	85	12	27	14.12%	16.67%	9	3	0	75.00%	25.00%	0.00%
Totals	9 Readers		**1666**	**889**	**182**	**238.3**	**20.47%**	**14.30%**	**140**	**28**	**14**	**76.92%**	**15.38%**	**7.69%**
1840-1859														
The School Rr. 2nd	Sanders	1840	180	73	11	33	15.07%	18.33%	9	1	1	81.82%	9.09%	9.09%
New Juv Rr No. 1	Cobb	1842	108	32	15	43.25	46.88%	40.05%	11.5	3.5	0	76.67%	23.33%	0.00%
New Juv Rr No. 2	Cobb	1843	144	25	7	24	28.00%	16.67%	6	0	1	85.71%	0.00%	14.29%
The School Rr. 1st	Sanders	1843	120	58	12	18.5	20.69%	15.42%	9	2	1	75.00%	16.67%	8.33%
Newly Rev1st	McGuffey	1844	108	61	8	13.5	13.11%	12.50%	8	0	0	100.00%	0.00%	0.00%
New Juv Rr No. 3	Cobb	1845	211	61	16	82.25	26.23%	38.98%	10.5	0	5.5	65.63%	0.00%	34.38%
The English Reader	Murray	1846	209	139	10	13	7.19%	6.22%	4	6	0	40.00%	60.00%	0.00%
Newly Rev Ec. 3rd	McGuffey	1848	216	79	15	43.75	18.99%	20.25%	12.5	1	1.5	83.33%	6.67%	10.00%
School Rr 3rd Book.	Sanders	1848	250	106	21	59.25	19.81%	23.70%	17.5	2.5	1	83.33%	11.90%	4.76%
Newly Rev Ec. 2nd	McGuffey	1853	224	65	9	16.75	13.85%	7.48%	7	1.5	0.5	77.78%	16.67%	5.56%
Totals	10 readers		**1770**	**699**	**124**	**347.3**	**17.74%**	**19.62%**	**95.0**	**17.5**	**11.5**	**76.61%**	**14.11%**	**9.27%**

Appendix 2 (Continued). Science content of nineteenth century readers by lesson and page.

					Science				Type of Sci Les					
1860-1879	**Author**	**Year**	**pp.**	**Les**	**Les**	**pp.**	**% Sci les**	**% Sci pp**	**BS**	**ES**	**PS**	**BS/scl**	**ES/scl**	**P.S./scl**
The School Rr. 3rd	Sanders	1861	113	264	9	20.75	3.41%	18.36%	8	1	0	88.89%	11.11%	0.00%
New 1st Eclec Rr	McGuffey	1863	84	63	14	12.5	22.22%	14.88%	12.5	1.5	0	89.29%	10.71%	0.00%
Primer or 1st Rr	Hillard	1864	60	52	6	6	11.54%	10.00%	6	0	0	100.00%	0.00%	0.00%
New 2nd Eclec Rr	McGuffey	1865	162	71	10	19.5	14.08%	12.04%	10	0	0	100.00%	0.00%	0.00%
New 3rd Eclec Rr	McGuffey	1865	242	86	6	16.5	6.98%	6.82%	5	0.5	0.5	83.33%	8.33%	8.33%
The School Rr. 2nd	Sanders	1869	204	85	8	19.75	9.41%	9.68%	7	0	1	87.50%	0.00%	12.50%
National First Rr	Parker &	1869	96	61	6	12.5	9.84%	13.02%	6	0	0	100.00%	0.00%	0.00%
National Third Rr	Parker &	1869	288	109	8	19.25	7.34%	6.68%	8	0	0	100.00%	0.00%	0.00%
The School Rr. 1st	Sanders	1871	120	77	22	26.75	28.57%	22.29%	22	0	0	100.00%	0.00%	0.00%
National Second Rr	Parker &	1871*	224	73	13	35.5	17.81%	15.85%	11	0	2	84.62%	0.00%	15.38%
New Series. 3rd Rr	Hillard &	1873	203	83	15	31.5	18.07%	15.52%	10.33	3.33	1.33	68.87%	22.20%	8.87%
Franklin 2nd Rr	Hillard &	1875	154	77	10	18.75	12.99%	12.18%	8	1	1	80.00%	10.00%	10.00%
Totals	12 Readers		**1950**	**1101**	**127**	**239.3**	**11.53%**	**12.27%**	**113.8**	**7.33**	**5.83**	**89.63%**	**5.77%**	**4.59%**
1880-1899														
Appletons 1st	Harris &	1884	90	32	2	2	6.25%	2.22%	2	0	0	100.00%	0.00%	0.00%
New 1st Eclec Rr	McGuffey	1885	84	63	14	12.5	22.22%	14.88%	12.5	1.5	0	89.29%	10.71%	0.00%
New 3rd Eclec Rr	McGuffey	1885	242	86	6	15.75	6.98%	6.51%	5	0.5	0.5	83.33%	8.33%	8.33%
Appletons 2nd	Harris &	1886	142	69	8	14.75	11.59%	10.39%	6	0	2	75.00%	0.00%	25.00%
Appletons 3rd	Harris &	1887	214	71	8	24.25	11.27%	11.33%	7	1	0	87.50%	12.50%	0.00%
2nd Ec. Rr. Rev Ed	McGuffey	1896	160	71	13	28.5	18.31%	17.81%	13	0	0	100.00%	0.00%	0.00%
Baldwins Rrs 1st	Baldwin	1897	128	128	22	23	17.19%	17.97%	19	3	0	86.36%	13.64%	0.00%
Baldwins Rrs 2nd	Baldwin	1897	160	48	8	28	16.67%	17.50%	8	0	0	100.00%	0.00%	0.00%
Baldwins Rrs 3rd	Baldwin	1897	208	50	8	42.5	16.00%	20.43%	8	0	0	100.00%	0.00%	0.00%
Totals	9 Readers		**1428**	**618**	**89**	**191.3**	**14.4%**	**13.39%**	**80.5**	**6.0**	**2.5**	**90.45%**	**6.74%**	**2.81%**

Les = Lesson

pp. = pages

Science Les = number of lessons devoted to science.

Science pp. = number of pages devoted to science (to the nearest quarter of a page).